Social representations of science at the commission hearings into the decline of Sockeye salmon in British Columbia, Canada: Relying on good science or indulging in speculation?

Michelle Riedlinger
University of the Fraser Valley, British Columbia, Canada

Introduction

Researchers argue that the challenge for decision makers (and, by extension, science communicators involved in decision making) is how to manage scientific and technological developments in the context of diverse values and differing representations (see, for example Bauer & Gaskell, 2008). Scientific developments and technological innovations often come with a large and recognized gap in knowledge. In fact, a lack of knowledge is a necessary starting point for any scientific endeavor. Politics has been defined as the management of uncertainty—or the state of having imperfect or unknown information (see Hall and Taylor, 1996 citing rational choice institutionalism). Yet, managing a lack of scientific knowledge in modern decision-making settings can be particularly challenging because the political, moral and legal implications of scientific developments are often confused with scientific considerations (Scheufele, 2014). Nielsen and Sorensen (2015) call for science communicators to better recognise the lack of knowledge (or unknowns) about scientific and technological developments to encourage more dialogic approaches in science communication.

Researchers have found that the lack of knowledge (or non-knowledge) accompanying scientific developments can take a number of forms. The lack may be considered “undone science” where an absence of funding or technical feasibility can leave the science undone (Hess, 2015). Non-knowledge can also arise from selective ignorance where particular kinds of knowledge are neglected for social or political reasons (Elliot, 2015). The use of non-knowledge as a persuasive policymaking tool to support governance positions and counter criticism had been recognized since Weiss wrote about the multiple uses of research utilization in 1979. A growing number of researchers have identified the tactical use of non-knowledge for meeting the particular rhetorical goals of decision makers working in environmental and sustainability areas, such as delaying action (Hess, 2015; Elliot, 2015 and Frickel & Vincent, 2011). Researchers have identified the persuasive linguistic markers associated with the representation of this non-knowledge (Janich & Simmerling, 2015; Simmerling & Janich, 2016), including metaphors and other grammatical features that collude to construct reality in particular ways. For example, metaphors can convey vivid images directly to the minds of readers and listeners. Simmerling and Janich identify the metaphoric examples of “unmapped terrain” and “stepping into the unknown” as ways that a lack of scientific knowledge is often represented. Other linguistic markers that emphasize a lack of knowledge include the use of modal expressions (e.g. could, might), reporting verbs (e.g. think or suggest), specific word choices (e.g. error, ignorance, doubt, controversy, risk, uncertain) and other expressions (e.g. lack of data, unresolved issues, contested). While recent work has looked at the rhetorical functions of these linguistic markers of non-knowledge, little research has looked at the use of them in strategic

negotiations by various community representatives in decision-making settings and the implications for science communication.

The environmental health of British Columbia's wild Sockeye salmon

To investigate the various and competing social representations of non-knowledge, this study focuses on the controversy surrounding the disappearance of wild Sockeye salmon in British Columbia. The wild salmon fishery in British Columbia is worth over $1 billion dollars annually. However, in 2009 wild Sockeye salmon productivity declined to the point where returns of salmon were less than the replacement rate (Cohen, 2012). The decline occurred despite policy interventions that required substantial reductions in fisheries' harvests. The Prime Minister of Canada, Stephen Harper announced a judicial inquiry (Commission of Inquiry into the Decline of Sockeye Salmon in the Fraser River—or the Cohen Commission Inquiry—held in 2010 and 2011) into what was termed as a wild Sockeye salmon collapse.

Establishing the ecological and physical health of Sockeye salmon is challenging for researchers because the fish migrate from ocean to river environments. An adult Sockeye salmon matures in the ocean at four to five years of age and the mature female Sockeye salmon journeys back to her birthplace where she deposits her eggs and dies (Cohen, 2012). The political environment associated with wild salmon management is also complex; communities of interest who are concerned with the environmental health of salmon in BC have diverse and sometimes conflicting perspectives. Fish farms have been blamed for the decline in wild salmon populations (see for example, Casselman, May 5, 2011) and environmental groups consistently lobby for the removal of salmon aquaculture in the Province. Activists have been collecting their own data on the health of wild salmon in the hope of swaying decision makers to apply more regulation to fish farms (see for example Dean, Nov 3, 2008). They have had some success in curbing the movement of farmed salmon and preventing particular salmon farming practices (CBC News, May 07, 2015). Canada's Department of Fisheries and Oceans is responsible for managing BC's wild salmon stocks. They also regulate and promote the salmon aquaculture industry in BC. First Nations communities have been calling for joint management with government of the wild salmon fishery for some time. Research into wild Sockeye salmon health conducted by Dr Kristy Miller from the Canadian government's, Department of Fisheries and Oceans was occurring at the same time as the Sockeye salmon decline. This study focuses on the various and competing social representations and uptake of non-knowledge associated with Miller's research during that time.

Miller's genomic research into viral signatures identified in BC's Sockeye salmon was first published in the journal, *Science* in January, 2011. The study was a collaborative effort between government and university researchers, but the genomic signature research was primarily conducted in Miller's laboratory. The study made a connection between high rates of mortality in BC's wild Sockeye salmon and what the researchers described as a "mortality-related genomic signature" (Miller, 2011, p. 214). Although *Science* issued a media release, Dr Miller was banned by the federal government from

speaking to the media about her genomics research until after she had testified at the Cohen Commission Inquiry. Media uptake of this research introduced many issues not referenced in the original *Science* article, including a lack of transparency and open communication by government when reporting on environmental management, excessive control by authorities when knowledge is contested, and the role of fish farms in the decline of wild salmon. By July 2011, Miller and colleagues' "scientific discovery" had been transformed into a case of a government researcher being suppressed from communicating her research for reasons of political and industrial interests (see for example, Munroe, July 27, 2011). Representatives of many communities of interest, concerned with the health of wild Sockeye salmon, cross-examined Dr Miller during her testimony at the Cohen Commission Inquiry.

Approach

The corpus for this study consisted of Miller's recorded testimony at the Cohen Commission Inquiry and stakeholder responses to Miller's work (Miller's cross-examination, media reporting of these events in Canada's national newspaper, the *Globe and Mail*, and government media communication about Miller's ongoing research). Dr Miller was called to testify at the Inquiry for two days in August and one day in December 2011. The responses to Miller's work included in this study are those made by salmon industry representatives, environmental group representatives, First Nations community representatives and government fisheries managers. Using a pragmatics-based analysis, I identified the linguistic markers and representations of non-knowledge associated with Miller's ongoing research. I also considered the uptake of these commonsense representations by the media and Hon. Cohen in the final Cohen Commission reports. I particularly focused on metaphors and trigger words that invoked particular frames of non-knowledge, appraisal patterns (if non-knowledge was framed positively or negatively), and modal expressions indicating a lack of knowledge (e.g. could be, perhaps).

Findings and Discussion

The smoking gun

"The smoking gun" was one of the most common metaphors identified during Miller's testimony at the Cohen Commission. This metaphor invokes the idea of a known perpetrator or culprit. Mr Gregory McDade, representing BC's environmental advocates under the umbrella of the "Aquaculture Coalition" first introduced the term, "the smoking gun" when cross-examining Miller about her hypothesis that a viral infection was the cause of wild salmon decline:

> Mr McDade: …this, in fact, may be **the smoking gun** for the 2009 declines?

While Miller indicates a lack of knowledge in her response by the inclusion of the modal, "could", she does not deny the possibility that her findings indicate that a viral infection is the cause for declining Sockeye salmon:

> Dr Miller: It could be **the smoking gun**.

Miller attempts to increase the non-knowledge around this statement, using the expressions "potential" and "some level" to indicate areas where there is still a lack of knowledge. However, these markers compete with linguistic markers indicating knowledge certainty, such as "certain" and "confidence":

> Dr Miller: **Certainly** given the prevalence rates of fish that we see in certain years with this parvovirus there is **certainly the potential** that this virus could have a major impact on salmon declines.
>
> Dr Miller: I have **some level of confidence** that we will find disease with this virus, but we do have to do the work.

Miller's testimony was reported in the *Globe and Mail* the next day with the headline:

> DFO scientist says that she **may have 'the smoking gun'** that killed Fraser River Sockeye

The use of the modal expression "may" marks the statement as non-knowledge but the use of the verb "have" indicates that Miller possesses the relevant knowledge to identify the cause of Sockeye salmon decline.

On the second day of Miller's testimony in August 2011, Ms Brenda Gaertner, legal counsel for the First Nations Coalition and the First Nations Fisheries Council criticized Miller's adoption of the metaphor, "the smoking gun" for its association with violence. She asked Dr Miller:

> Ms Gaertner: …what did you mean yesterday when you said that this was **a smoking gun**?"

Here Gaertner replaces the specific "the" smoking gun with the more general "a" smoking gun. This change reduces the specificity of the metaphor to indicate that this may not be the only cause. Miller responds that she did not intend to use the term "smoking gun" and instead states that a potential virus "could be a major factor" but that "there is no single major factor". Miller states that her intention was to highlight the unknowns about the research findings:

> Dr Miller: I think that I did put **a lot of ifs, ands and buts** in at the time that I made that statement.

Mr Tim Dickenson representing the Sto:lo Tribal Council and the Cheam Indian Band also rejects the "smoking gun" metaphor:

> Mr Dickensen: We **do not have a smoking gun scenario**. Rather, we have **a scenario of a thousand cuts** suffered by the sockeye as they travel down the river and up the coast and back again.

Mr Dickensen replaces the metaphor of the "smoking gun" with another metaphor "a scenario of a thousand cuts". This alternative metaphor, associated with a method of torture, indicates multiple causes of Sockeye salmon mortality. The number "1000" is a very general round number, and the lack

of specificity around the origin of the cuts points to a lack of specific knowledge. Both of the First Nations representatives rejected the idea of one single cause for Sockeye salmon decline.

In the final Cohen Commission report, the Commissioner, the Hon. Bruce Cohen invokes the "smoking gun" metaphor. It appears 12 times in the final report but is always appraised by Hon. Cohen negatively (representing non-knowledge). For example:

> Hon. Cohen: Some, I suspect, hoped that our work would find **the "smoking gun"** – a single cause that explained the two-decade decline in productivity. The idea that a single event or stressor is responsible for the 1992–2009 decline in Fraser River sockeye **is appealing but improbable** (p. 88).

The detective story

The "detective story" metaphor, representing a need to answer questions, also gained some traction during Miller's testimony. Mr Gregory McDade, from the Aquaculture Coalition (Environmental) introduces the metaphor of the detective story when examining Miller:

> Mr McDade: …It's a bit of **a detective story**, as I hear it, **unwinding** some of this, and clearly we're in the middle of a scientific process.

Adopting a detective story metaphor in the context of the Commission Inquiry may be understandable given the court-like environment; culprits are caught and put on trial. Yet, Miller does not take up this metaphor. She responds instead with her own metaphoric framing of scientific non-knowledge associated with transportation and progress:

> Dr Miller: I'm sure hoping not. And, you know, we've **cut a lot of corners** and I think we've come **really far and really fast**, but there are some experimental studies that have to be done before we can **move too far forward**.

The "detective story" metaphor is picked up by the Canadian media. The *Globe and Mail* reports on the hearing with the title, "The case of the missing fish" and the lead paragraph asks:

> So many suspects, so much conflicting evidence. Can the Cohen Commission root out what happened to the salmon?

Speculation and unfounded science

Between her first visit to the Cohen Commission in August 2011 and her second visit in December 2011, Miller identified a genomic sequence in Sockeye salmon that matched an existing virus—infectious salmon anemia virus. She communicated her findings to her employer, DFO who then investigated their laboratories for confirming evidence. After a technical briefing involving DFO scientists, the Hon. Keith Ashfield, Minister of Fisheries and Oceans, released the following media statement:

> After Canada's reputation has **needlessly been put at risk** over the past several weeks because of **speculation and unfounded science**, additional in-depth, conclusive tests, using **proper and internationally recognized procedures**, are now complete and we can confirm that there has never been a confirmed case of ISA in BC salmon, wild or farmed.

Government fisheries managers focused on representing Miller's scientific development as non-knowledge by describing it using the non-knowledge synonym of "speculation" and the trigger word "unfounded", invoking a faulty building metaphor. The assertion and positive appraisal of government lab testing in contrast to Miller's testing, implied that the opposite could be true for Miller's laboratory (i.e. Miller's testing may be shallow, inconclusive, improper and not internationally recognized). The release also highlighted the negative implications of Miller's research findings—the presence of a known virus in BC's wild Sockeye salmon population would negatively affect Canada's international reputation.

After this government media release was issued, Miller was called to testify again at the Cohen Commission Inquiry. DFO managers focused their cross-examination on the certification of their laboratory and the lack of certification of Miller's laboratory, which could be viewed as an attempt to create doubt about Miller's expertise and findings. Salmon aquaculture representative, Mr Alan Blair representing the B.C. Salmon Farmers Association focused his cross-examination on industry cooperation. Interestingly, the trigger words "contacted" and "cooperating" in his testimony, position the aquaculture industry as a possible suspect in a crime:

> Mr Blair: The aquaculture industry **has been contacted and is cooperating** with the DFO and Dr. Miller's research as it evolves.

However, Blair also echoed the federal government's focus on Miller's research being non-knowledge by pointing to other examples of problematic research communication:

> Mr Blair: Each one of these risks [to wild salmon] is brought breathlessly to the public in **a sensational way**, and each one so far has been demonstrated to be **something less than advertised**.

Mr Rosenbloom, representing the BC Commercial Fishermen's Association who rely on wild salmon populations for their livelihood, focused his cross-examination of Miller on the negative reception of her findings by DFO fisheries managers:

> Mr Rosenbloom: Would you not agree with me that some of your superiors would be **unhappy** that **positive results** would lead to an internationally bad reputation for Canada?

Using the trigger word of DFO "unhappiness" frames DFO's response to Miller's findings as an irrational rather than a rational response. The use of the appraisal term "positive" when referring to Miller's

findings also supports her work as knowledge. Miller responded to Rosenboom by directly addressing the science-policy interface and considering how her findings could best be situated in decision-making:

> Dr Miller: Oh, I think that there's some underlying issues with that for sure…the sentiment I got was that **research should not fog policy**, so – but my take, as a scientist, is that **research should inform policy**, and if policy has to change based on new findings, then that's what it has to do. But I don't come from a manager's standpoint, I come from a scientist's standpoint.

Miller contrasts the verb "fog" with the verb "inform" when relating research and policy; her superiors are associated with a weather metaphor for obscuring. Miller also positions herself as a scientist twice in this short paragraph, communicating her role as knowledge "expert".

DFO's framing of Miller's research as "speculative and unfounded" was not picked up by the mainstream media after the hearing. Hon. Cohen interpreted DFO's response to Miller's research as an attempt to maintain non-knowledge (or selective ignorance) about wild Sockeye salmon health for political reasons:

> Hon Cohen: …the response within DFO to Dr. Miller's results is **especially puzzling** to me…if DFO **restricts its research** into fish health on wild salmon to meet the needs of one "client" (CFIA), it **jeopardizes its ability** to be **innovative** and risks **failing in its mandate** to conduct research that will **further scientific knowledge** about the health of wild sockeye salmon.

Conclusion

An examination of Miller's testimony and uptake of non-knowledge associated with Miller's research into the health of Sockeye salmon populations revealed that Miller mobilized and resisted particular common sense research frames associated with her ongoing research. Representatives of some groups (environmentalists and commercial fishermen) invoked common sense frames associated with finding a culprit (metaphors of the smoking gun and the detective story) and the politicization of science (invoking affective frames associated with government resistance to Miller's findings). The frames align with the existing commonsense understandings of environmental groups and commercial fishermen in BC. Miller adopted these frames in places during her testimony where she was positioned as an advocate for her own research. The *Globe and Mail* also picked up the metaphors of the "smoking gun" and the "detective story" in their reporting, indicating a preference for framing Miller's research as the search for a culprit. These frames align with existing news values where a focus on agents and action is preferred. In contrast, representatives of First Nations communities put their focus on the complexity of the salmon ecosystem (rejecting "the smoking gun" metaphor in preference for a "death by 1000 cuts" metaphor). This metaphor aligns with First Nations peoples' understanding that co-management is the only way to protect the complexity of the wild salmon ecosystem in BC. DFO managers and BC's aquaculture industry rejected framings of Miller's work as the search for a culprit. They appraised

Miller's ongoing research, as negative non-knowledge using trigger words such as "unfounded", "speculative", and "sensationalized". DFO managers criticized Miller's testing methods, while the aquaculture industry referred to previous cases where research findings into salmon health issues were overestimated.

Scheufele (2014) argues that stakeholders rely on their pre-existing values, beliefs and understandings to make sense of new knowledge. While it is clear that no one "public" common sense representation of Miller's ongoing research may ever be shared by all communities of interest, some representations may be less productive for science communicators than others. Scheufele (2014) calls for scientists to pay more attention to the language they use when talking about science. This current study shows that responses to (always) incomplete scientific understanding—or non-knowledge—differ markedly and are negotiated through strategic language choices such as metaphor, appraisal patterns and modal expressions. Understanding how various stakeholder groups talk about the lack of knowledge associated with ongoing scientific developments in cases such as this is important for helping researchers shape their communication about non-knowledge. Metaphors and trigger words invoking "culprits" and "blame" and appraisal patterns that frame ongoing research developments as negative non-knowledge (e.g. speculation) can be considered attempts to close down participation in public discussions of science.

Miller appraised her research positively as an incomplete process through the use of trigger words associated with transport and mapping progress, and modal expressions indicating a lack of absolute knowledge. First Nations representatives used metaphor to emphasize the complexity of salmon decline and Miller's research as one important component to consider. These representations and the associated linguistic choices may be good starting points for communicators wishing to identifying shared representations that do not appraise non-knowledge in ongoing research negatively. They may encourage more dialogic communication, as Nielsen and Sorensen (2015) suggests by introducing commonsense understandings of research that are open to incorporating knowledge from multiple communities of interest.

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